FORM PTO-1390 (REV 9-2001) U S DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTORNEY'S DOCKET NUMBER
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		197.022/10011942
		US APPLICATION NO (If known, see 37 CFR 1.5) 10/018364
INTERNATIONAL APPLICATION NO. PCT/EP00/04553	INTERNATIONAL FILING DATES 20/05/2000	PRIORITY DATE CLAIMED 25/06/1999
TITLE OF INVENTION PROCESS FOR MOBILE RECEPTION OF TELEVISION SIGNALS AND A CIRCUIT FOR EXECUTING THE PROCESS		
APPLICANT(S) FOR DO/EO/US Wolfgang Sautter, et al.		

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. [x] This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. [ ] This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing 35 U.S.C. 371
3. [ ] This is an express request to begin national examination procedures (35 U.S.C. 371 (f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. [x] The US has been elected by the expiration of 19 months from the priority date (PCT Article 31).
5. [x] A copy of the International Application as filed (35 U.S.C. 371 (c)(2))
   a. [ ] is attached hereto (required only if not communicated by the International Bureau).
   b. [x] has been communicated by the International Bureau.
   c. [ ] is not required, as the application was filed in the United States Receiving Office (RO/US).
6. [x] An English language translation of the International Application as filed (35 U.S.C. 371 (c)(2)).
   a. [x] is attached hereto.
   b. [ ] has been previously submitted under 35 U.S.C. 154(d)(4).
7. [x] Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
   a. [ ] are attached hereto (required only if not communicated by the International Bureau).
   b. [ ] have been communicated by the International Bureau.
   c. [ ] have not been made; however, the time limit for making such amendments has NOT expired.
   d. [X] have not been made and will not be made.
8. [ ] An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).
9. [ ] An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
10. [X] An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).

Items 11 to 20 below concern document(s) or information included:

11. [x] An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. [ ] An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. [x] A FIRST preliminary amendment.
14. [ ] A SECOND or SUBSEQUENT preliminary amendment.
15. [x] A substitute specification.
16. [ ] A change of power of attorney and/or address letter.
17. [ ] A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
18. [ ] A second copy of the published international application under 35 U.S.C. 154(d)(4).
19. [ ] A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
20. [x] Other items or information: International Search Report, PTO-1449, and 10 prior art references, Letter to Draftsman Submitting Formal Drawing, One Sheet of Drawing, Early Notification of Serial Number postcard

U.S. APPLICATION NO (if known, see 37 CFR 1.5)	INTERNATIONAL APPLICATION NO	ATTORNEY'S DOCKET NUMBER
10/018364	PCT/EP00/04553	197.022/10111942

21. [x] The following fees are submitted:

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) – (5)):

		CALCULATIONS PTO USE ONLY
[ ]	Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO $1040.00	
[x]	International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO $890.00	
[ ]	International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO $740.00	
[ ]	International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) $710.00	
[ ]	International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) $100.00	

ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 890.00	
Surcharge of $ 130.00 for furnishing the oath or declaration later than [ ] 20 [x] 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).	$ 130.00	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	20-20 =		x	$ 0.00	
Independent claims	2-3 =		x	$ 0.00	
MULTIPLE DEPENDENT CLAIM(s) (if applicable)			+	$	
TOTAL OF ABOVE CALCULATIONS =				$ 1,020.00	
[ ] Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by ½.				$	
SUBTOTAL =				$ 1,020.00	
Processing fee of $ _____ for furnishing the English translation later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 CFR 1.492 (f)). +				$	
TOTAL NATIONAL FEE =				$ 1,020.00	
Fee for recording the enclosed assignment (37 CFR 1.21 (h)). Assignment must be accompanied by appropriate cover sheet (37 CFR 3.28, 3.31) (per property). +				$	
TOTAL FEES ENCLOSED =				$ 1,020.00	
				Amount to be Refunded:	$
				Charged:	$

a. [x] A check in the amount of $ 1,020.00 to cover the above fees is enclosed.

b. [ ] Please charge my Deposit Account No. _____ in the amount of $ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. [x] The Commissioner is hereby authorized to charge any additional fees which may be required or credit any overpayment to my Deposit Account No. 06-2375 Under order no. 197.022/10111942. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137 (a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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SIGNATURE:

William E. Bradley
NAME

42,355
REGISTRATION NUMBER

Attorney Docket No. 197.022

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	§
	§
Wolfgang Sautter	§
	§
Serial No.: To be assigned	§
	§
Filing Date: Herewith	§
	§
Title: PROCESS FOR MOBILE RECEPTION OF TELEVISION SIGNALS AND A CIRCUIT FOR EXECUTING THE PROCESS	§

PRELIMINARY AMENDMENT UNDER 37 C.F.R. § 1.115

Assistant Commissioner for Patents
Box Patent Application
Washington, D.C. 20231

Dear Sir:

Applicant respectfully requests entry of the following amendments prior to calculation of the filing fees in connection with the above-captioned application.

AMENDMENTS

In The Specification:

Please replace the original specification as filed with the substitute specification submitted herewith. Applicant's representative submits that: (1) consistent with 37 C.F.R. §1.125(b)(1), the substitute specification includes no new matter and merely conforms the translation and specification (as amended pursuant to PCT Article 34) into the preferred layout of U.S. practice;

and (2) consistent with §1.125(b)(2), a marked-up copy of the translation of the specification (as amended pursuant to PCT Article 34) showing the changes made is also enclosed herewith.

IN THE CLAIMS:

Please cancel original claims 1-18. Please add new claims 19-38 submitted herewith on the attached pages. No new matter has been added.

19. (New) A process for mobile reception of television signals comprising:

receiving a plurality of different input signals;

time synchronizing said input signals using video synchronization pulses contained in said input signals;

evaluating the quality of said input signals using at least one criterion for determining an adaptively determined weighting factor;

weighting said input signals;

deriving an output signal based on said weighted input signals; and

feeding said output signal to a receiver.

20. (New) The process of claim 19, wherein said video synchronization pulses are selected from the group consisting of horizontal video synchronization pulses and vertical synchronization pulses.

21. (New) The process of claim 19, wherein said output signal is derived by summing said weighted input signals.

22. (New) The process of claim 19, further comprising the step of setting a time interval for evaluating the quality of said input signals.

23. (New) The process of claim 19, further comprising the step of delaying said input signals before deriving said output signal to allow determination of said weighting factors.

24. (New) The process of claim 23, wherein a FIFO memory is used for said delay.

25. (New) The process of claim 19, wherein said input signals are digital signals.

26. (New) The process of claim 25, wherein each of said input signals is received with its own antenna and its own tuner.

27. (New) The process of claim 26, wherein high frequency signals received with said antennas are already digitally modulated.

28. (New) The process of claim 27, wherein said input signals comprise analog and digital signals having luminance and chrominance portions produced by video decoders serially connected to said tuners.

29. (New) The process of claim 28, wherein said luminance and chrominance portions of each input signal is evaluated, weighted, and summed independently of one another.

30. (New) The process of claim 19, wherein said criterion is selected from the group consisting of magnitude of noise level, signal-to-noise ratio of a signal level, and occurrence of interference.

31. (New) The process of claim 30, wherein at least two of said criterion are used to evaluate the quality of said input signals.

32. (New) The process of claim 19, wherein said criterion is based on a presence of a deterministic signal portion.

33. (New) The process of claim 19, wherein said input signals are weighted relative to their rating as compared to the input signal having the highest rating for said criterion.

34. (New) The process of claim 33, further comprising the step of setting a threshold rating relative to the input signal having the highest rating and assigning input signals falling below said threshold rating a weight factor of zero.

35. (New) The process of claim 19, wherein said input signals are video signals and are received during said receiving step.

36. (New) The process of claim 19, wherein after deriving said output signals, said output signals are buffered and undisrupted signals received before a period of interference are transmitted to said receiver.

37. (New) The process of claim 19, further comprising the step of setting receiving paths for input signals not contributing to improving said output signal to different frequency ranges having the same information.

38. (New) A circuit for allowing mobile reception of broadcast signals comprising:

a synchronization unit for time synchronization of input signals, said unit having a first FIFO memory for each signal;

a clock generator;

a synchronization control unit;

a signal conditioning unit, wherein each synchronized input signal is subjected to a signal evaluation circuit and a following means for forming weighting factors, and wherein a second FIFO memory having a storage depth corresponding to a period of time of signal evaluation and formation of weighting factors;

a multiplication and summing means for forming output signals; and

a receiver having a reproduction part in communication with an output of said multiplication and summing means.

REMARKS

The amendment to the claims has been made to place the application in better condition for examination. Should the Examiner have any questions, comments, or suggestions, the Examiner is invited to contact Applicant's representatives at the number indicated below.

Respectfully submitted,

Date: 19 DEC 2001

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PROCESS FOR MOBILE RECEPTION OF TELEVISION SIGNALS AND A CIRCUIT FOR EXECUTING THE PROCESS

BACKGROUND OF INVENTION

1. Field of the Invention

The present invention relates to a process for mobile reception of broadcast signals and a circuit for executing the process. More particularly, the present invention relates to a process and circuit for mobile reception of television.

2. Description of the Related Technology

Formation of an output signal which is supplied to the receiver by summing of input signals weighted according to quality criteria is already known from documents US 5,528,581, DE 38 33 709 A1, DE 197 08 996 A1 and US 5,465,271.

Compared to other methods of multipath reception, as are known from DE 39 26 336 A1, DE 196 36 125 A1 and DE 197 39 898 A1, in which at any time only the use of one (the best) individual signal is enabled and thus the output signal supplied to the receiver is at most as good as the best input signal, an improvement can be achieved compared to the best input signal by addition of weighted input signals.

This advantage however can only be achieved when the transit time differences of the received television (signals generally caused by different propagation paths) are determined and equalized before their addition. Without this compensation, as is the case in the diversity transmission system described in US patent 5,528,581, the acquired useful information is not improved, but degraded.

Generally a path difference and thus a transit time difference of the received signals occur on different propagation paths of a signal. By summing of reception signals the

received useful information is not improved, but degraded. It is therefore necessary to determine and equalize the transit time differences before addition.

Transit time equalization is not disclosed in U.S. 5,528,581.

In the diversity process of DE 38 33 709 A1, first the respective phase of the HF carrier oscillations of the various reception signals is determined and then phase correction is done for compensation of transit time differences.

Instead of the phases of the HF signals, also those of the pertinent IF signals can be determined and thus delay correction circuits can be controlled, as is the case in the diversity process according to DE 197 08 996 A1.

The phase synchronization however has the disadvantage which is serious for practical use that the determined phase differences of the HF(IF) signals are always in the range between 0 and 2π. A phase shift of 2π corresponds to a time shift by the period duration T of the corresponding carrier oscillation. If between the reception signals time shifts larger than the period duration T occur, they are no longer correctly equalized and addition does not lead to an improvement in quality. This process, also called "PCD" (phase controlled diversity), would only allow equalization of alternate routes up to 0.35 m for example at a receiving frequency of 855 MHz. When PCD is used in current television, for very small path differences non-pertinent image contents would therefore be added and thus cause incorrect video reproduction.

Synchronization of the individual reception signals to one another is possible correctly only when the transmitted useful information itself is used to control synchronization. In U.S. 5,465,271, a digital communications system is described in which digital message bits are transmitted. Here the digital message is organized in frames and slots which contain a preamble. This is a special bit sequence which is known to the receiver. In this way the receiver can compare the received data to the data sequence known to it beforehand and can shift the individual reception signals to one another accordingly.

This known type of synchronization cannot be used in transmission of analog television signals since they have no frames, slots and preambles. Otherwise in this

communications system the "preambles" of the input signals can be decoded to a sufficient degree and evaluated in the receiver only when the input signals are undisturbed and have little noise. For weak input signals however this is not the case so that this type of synchronization is not suited for a process of the initially mentioned type.

SUMMARY OF INVENTION

An object of the invention is to provide a process for mobile reception of television signals in which reception is enabled or further improved even in multipath propagation, regardless of the length of the alternate routes and thus the magnitude of the transit time differences and in areas with low reception levels.

According to this object of the invention there is provided a process for mobile reception of broadcast signals in which an output signal (S_A) is derived from a number (n) of different input signals (i.e. S_1.....S_5) and is supplied to the reproduction part of a receiver. In accordance with one aspect of the invention, the input signals (S_1.....S_n) are weighted and the output signal (S_A) is formed by summing the weighted input signals. For weighting, the quality of each of the input signals (S_1.....S_n) is evaluated using at least one criterion which can be set for determining the adaptively determined weighting factors. According to this aspect, the n input signals (S_1...S_5) are time synchronized before their evaluation, summing and weighting. Horizontal and/or vertical video synchronization pulses contained in the input signals (S_1....S_5) may be used for control of time synchronization.

In this process with "time synchronization", the transit time difference of the reception signals is determined using the contained useful information and not using the phase angle of the carrier signal. By using deterministic signal portions, specifically the horizontal and vertical video synchronization pulses of the television signal, this can be done easily. The useful signals are then delayed against one another such that these signal portions (known beforehand) hit one another. The limit of the transit time equalization is no longer the period duration T of the carrier signal, but depends only on the type of deterministic signal portions contained (for example, their spacing) and the available memory.

This yields the advantage that at any time and essentially regardless of the size of the alternate signal routes and thus of the terrain traversed, on all input signals, the same useful information for weighting and summing is available.

The use of the vertical and horizontal video synchronization pulse contained in the transmitted television signal for controlling transit time equalization conversely has the advantage (which is very important for practical use) that, based on the reliable decodability of the video synchronization pulses, even for very weak reception signals, the required transit time equalization can be done even under poor reception conditions. Thus, under difficult conditions as often occur in practice, constructive weighted addition is enabled which leads decisively to improvement in the reception quality of the television picture.

The invention relates to mobile reception of television signals. In addition to video content, data such as teletext are also transmitted. It would be conceivable to decode these data and to use the "frame/slot/preamble" to control synchronization similarly to U.S. 5,465,271. But this would have the major disadvantage that decoding of digital information transmitted at the same time (like teletext) is possible only under very good receiving conditions. For this case however, weighted addition is no longer necessary, since then the receiving quality is good anyway.

Other advantageous embodiments of the present invention are set forth in the claims.

According to one aspect of the invention, a time interval, and thus a certain amount of data, can be stipulated for evaluation of n input signals. Thus a favorable compromise which can be adapted to the circumstances of the individual case between the attainable speed of the process and sufficient evaluation reliability is possible.

According to another aspect of the invention, delay of the input signals ensures that correct weighting of the signals is done when the result of evaluation changes according to the evaluation time intervals.

Simple implementation of this delay can be achieved for example by so-called FIFO (first-in first-out) memories.

In accordance with a further aspect of the invention signal processing, therefore synchronization, signal evaluation and weighting, storage, multiplication and summation, can be accomplished especially easily and effectively when the input signals are digital signals.

In a presently preferred embodiment, each input signal (S_1.....S_n) is received with its own antenna. According to this embodiment, with multipath reception in motor vehicles, the output signals of the tuners form the input signals for the following signal processing unit.

The invention contemplates various alternatives for preparing digital input signals in a multiantenna reception system. For example, high frequency signals received with antennas may already be digitally modulated. On alternatively, for example, television signals may be analog and digital input signals (S_1.....S_n) with luminance and chrominance portions produced by video decoders connected in series to tumors.

By evaluating the different signal portions of each input signal, and specifically the luminance and the chrominance portions, the brightness and color signal of the various reception signals which is best at the time can be used for weighted summing.

The separation of the luminance and chrominance signal makes it possible for the two signals to be evaluated independently of one another, therefore criteria which are optimum at the time for evaluation and weighting of these signal portions can be used and thus the quality of the output signal in which the optimum luminance and chrominance signal are combined in a standard manner can be further improved.

Any suitable criteria for evaluating signals may be employed with the present invention. For example, with color television signals, the magnitude of the noise level, the signal-to-noise ratio (of the signal level) or the occurrence of interference maybe be selectively used as criterion for evaluation of the quality of the input signals (S_1.....S_n). Alternatively, for example, the presence of a deterministic signal portion may be used as the criterion for evaluation. Likewise, as will be appreciated, a combination of any of these, or other, criterion may be used to evaluate the quality of input signals (S_1.....S_n).

Deterministic signal portions, for example, the horizontal and vertical synchronous information and the auxiliary color carrier in the current color television picture are predetermined, always present and prescribed signal components.

If the deterministic signal portions are absent or they are so faint that they cannot be detected, the pertinent input signal is preferably not evaluated nor relayed for weighting.

A presently preferred weighting scheme weights the input signals based on their rating compared the input signal which is rated the best.

According to the invention, an especially simple and economical evaluation of input signals is achieved by equating input signals which, compared to the input signal assessed as best, fall below a certain threshold to be weighted as a zero. Typically, these signals do not deliver a positive contribution to the output signal in the first place.

According to another aspect of the invention at least one further block of m input signals (for example, audio signals) are evaluated in the described manner in addition to the first block of n input signals (for example, video signals) in order to improve their quality likewise and/or relative to the best individual signal.

In accordance with the invention, in case of brief disruptions of reception during which the quality of all input signals cannot be used, the output signals may be buffered (after weighted summing) and the undisrupted signals received before the disruption are transmitted. As will be appreciated, this simple manner, without high cost, the situation where no signal reaches the reproduction part of the receiver, for example, a monitor, during these disruptions, is avoided.

According to another aspect of the invention, input signals which do not contribute to the improvement of the output signal are not simply weighted very low or with zero, but are tuned to another frequency range with the same useful information, for example, another television channel with the same program but better quality (frequency diversity).

It is another object of the invention to provide a circuit for carrying out the aforementioned process. According to this object of the invention there is provided a circuit comprising a synchronization unit for time synchronization of the and/or m digital input

signals (S_1.....S_n) consisting of one FIFO memory for each signal, a clock generator and a synchronization control unit. A signal conducting unit is provided in which each of the synchronized input signals (S_1.....S_n) is supplied via a signal evaluation circuit and a following means (for forming weighting factors) and another FIFO memory with a storage depth which corresponds to the time interval of signal evaluation and formation of the weighting factors. A multiplication and summary means is connected to a reproduction part of a receiver.

DETAILED DESCRIPTION

The receiving means 1 for television reception in motor vehicles, for example in a passenger car, consists of a receiving unit 2, a synchronization unit 3 and a signal conditioning unit 4.

In the receiving unit 2 there are a number of different antennas, in this embodiment five different antennas 5, which are located at different points on the motor vehicle for receiving the same television program which can reach the antennas 5 as a result of the terrain structure by reflections on several propagation paths.

A tuner 6 tuned to the same useful signal in this example a (TV program) and a video decoder 7 are connected in series to each antenna 5. The tuners 6 can be tuned either to the same television channel or to different channels which transmit the same television program.

The synchronization unit 3 consists of one FIFO memory 8 each for each video signal delivered by the video decoders 7 and a clock generator 9 and a synchronization control unit 10.

In the signal conditioning unit 4 the output signals of the synchronization unit 3, therefore the input signals S_1...S_5 are delivered on the one hand via another FIFO memory 11 and on the other hand via an evaluation circuit 12 with a series-connected means 13 for determining the weighting factors to a multiplication and summing means 14 which is connected on the output side (optionally via a D/A converter) to a screen (not shown). The high frequency signal received by the antennas 5 is relayed to the series-connected tuners 6.

The latter demodulate the respective television signal and make available the analogous FBAS signal at their outputs.

The video decoders 7 digitize these FBAS signals and separate the luminance and chrominance signal.

In addition to digital video data, the video decoders 7 deliver the pertinent clock and synchronization signals and status signals which show for example the presence of the color video carrier.

The receiving unit 2 thus makes available on five paths digital video data with the pertinent clock and synchronization data, these data of the individual paths being staggered in time to one another generally due to the different reception paths.

These time shifts are eliminated in the synchronization unit 3. To do this, in the clock generator 9 using a common system clock and in the synchronization control unit 10 using the n input synchronization signals, control signals are produced from the input clock signals control the FIFO memory such that, at their output, the digital video data are synchronized in time, and therefore have a common clock and synchronization signal.

These synchronized input signals $S_1...S_5$ are now subjected to the process in the signal conditioning unit 4. To do this, first the signal quality is assessed with respect to given criteria in the evaluation circuit 12 in parallel for all five paths. Then, the pertinent weighting factors are determined from the results of these signal evaluations in the means 13.

Then the five synchronized input signals $S_1...S_5$ are multiplied by the pertinent weighting factors in the multiplication and summing means 14 and these adaptively weighted signals are added to an output signal S_A which is supplied to the screen optionally via a D/A converter. So that the correct video data are used for the adaptively weighted summing, specifically those which have already been used for evaluation and determination of the weighting factors, the input signals $S_1...S_5$ are delayed in a FIFO memory 11 with a storage depth which corresponds to the time interval which is necessary for evaluation and determination of the weighting factor. In this example there is one video line at a time.

Summing of all adaptively weighted video signals ensures that the output television signal S_A made available to the receiver in the least favorable case, i.e. when four input signals receive weighting zero, corresponds to the best of the five input signals and in all other cases has better quality.

CLAIMS

1. Process for mobile reception of television signals in which an output signal (S_A) is derived from n different ($S_1...S_5$) and is supplied to the reproduction part of the receiver, the n input signals ($S_1...S_5$) being weighted, the output signal (S_A) being formed by summing of the weighted input signals, and the quality of each of the n input signals ($S_1...S_5$) being evaluated using at least one given criterion for determining the adaptively determined weighting factors, characterized in that the n input signals ($S_1...S_5$) are time-synchronized before their evaluation, summing and weighting, and the horizontal and/or vertical video synchronization pulses contained in the input signals ($S_1...S_5$) are used for control of time synchronization.

2. Process as claimed in claim 1, wherein there is a time interval which can be set for evaluating the input signals ($S_1...S_5$).

3. Process as claimed in claim 1 or 2, wherein the input signals ($S_1...S_5$) are delayed before adaptive summing until the pertinent weighting factors are determined.

4. Process as claimed in claim 3, wherein a FIFO memory (11) is used for delay.

5. Process as claimed in one of claims 1 to 4, wherein the input signals ($S_1...S_5$) are digital signals.

6. Process as claimed in claim 5, wherein each of the input signals ($S_1...S_5$) is received with its own antenna (5) and its own tuner (6).

7. Process as claimed in claim 6, wherein the high frequency signals received with the antennas (5) are already digitally modulated.

8. Process as claimed in claim 7, wherein the television signals are analog and digital input signals (S_1...S_5) with luminance and chrominance portion are produced by the video decoders (7) connected in series to the tuners (6).

9. Process as claimed in claim 7 or 8, wherein the luminance and chrominance portion of each input signals (S_1...S_5) are evaluated, weighted, summed and then combined again in the standard manner independently of one another.

10. Process as claimed in claim 9, wherein the magnitude of the noise level, the signal-to-noise ratio of the signal level or the occurrence of interference are used selectively as the criterion to evaluate the quality of the input signals (S_1...S_5).

11. Process as claimed in claim 9, wherein the presence of a deterministic signal portions is used as the criterion to evaluate the quality of the input signals (S_1...S_5).

12. Process as claimed in claim 9, wherein a combination of criteria as claimed in claims 10 and 11 is used as the criterion to evaluate the quality of the input signals (S_1...S_5).

13. Process as claimed in one of the preceding claims, wherein the input signals (S_1...S_5) are weighted according to their rating compared to the input signal which has been rated best.

14. Process as claimed in claim 13, wherein the input signals (S_1...S_5), with a rating which falls below a threshold which can be set compared to the input signal rated best are weighted with the factor zero.

15. Process as claimed in one of claims 1 to 13, wherein parallel to the n input signals (S_1...S_5) with a certain content (video signals) at least m other input signals with another content (audio signals) are evaluated, weighted, and summed.

16. Process as claimed in one of claims 1 to 15, wherein after weighted summing, the output signals (S_A) are buffered and the undisrupted signals received beforehand are transmitted during brief interference.

17. Process as claimed in one of claims 1 to 16, wherein receiving paths with input signals (S_1...S_5) which do not contribute to improving the output signal are set to different frequency ranges with the same useful information, but better quality.

18. Circuit for carrying out one of the processes as claimed in claim 1 to 17, characterized by a synchronization unit (3) for time synchronization of the n or m digital input signals (S_1...S_5) consisting of one FIFO memory (8) for each signal, a clock generator (9) and a synchronization control unit (10), and by a signal conditioning unit (4) in which each of the synchronized input signals (S_1...S_5) is supplied on the one hand via a signal evaluation circuit (12) and a following means (13) for forming the weighting factors and on the other via another FIFO memory (11) with a storage depth which corresponds to the time interval of signal evaluation and formation of the weighting factors, to a multiplication and summing means (14) which is connected on the output side to the reproduction part of the receiver.

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ubstitute Specification

§371 of PCT/EP00/04553
Attorney Docket No. 197.022/10111942

PROCESS FOR MOBILE RECEPTION OF TELEVISION SIGNALS AND A CIRCUIT FOR EXECUTING THE PROCESS

BACKGROUND OF INVENTION

1. [Process]Field of the Invention

The present invention relates to a process for mobile reception of broadcast signals and a circuit for executing the process[The]. More particularly, the present invention relates to a process [as claimed in the preamble of claim 1]and [a]circuit for [executing the process]mobile reception of television.

2. Description of the Related Technology

Formation of an output signal which is supplied to the receiver by summing of input signals weighted according to quality criteria is already known from documents US 5,528,581, DE 38 33 709 A1, DE 197 08 996 A1 and US 5,465,271.

Compared to other methods of multipath reception, as are known from DE 39 26 336 A1, DE 196 36 125 A1 and DE 197 39 898 A1, in which at any time only the use of one (the best) individual signal is enabled and thus the output signal supplied to the receiver is at most as good as the best input signal, an improvement can be achieved compared to the best input signal by addition of weighted input signals.

This advantage however can only be achieved when the transit time differences of the received television (signals generally caused by different propagation paths) are determined and equalized before their addition. Without this compensation, as is the case in the diversity

transmission system described in US patent 5,528,581, the acquired useful information is not improved, but degraded.

Generally a path difference and thus a transit time difference of the received signals occur on different propagation paths of a signal. By summing of [these]reception signals the received useful information is not improved, but degraded. It is therefore necessary to determine and equalize the transit time differences before addition.

Transit time equalization is not [done]disclosed in [document]U.S. [D1.]5,528,581.

In the diversity process [known from document D2,]of DE 38 33 709 A1, first the respective phase of the HF carrier oscillations of the various reception signals is determined and then phase correction is done for compensation of transit time differences.

Instead of the phases of the HF signals, also those of the pertinent IF signals can be determined and thus delay correction circuits can be controlled, as is the case in the diversity process according to [document D3.]DE 197 08 996 A1.

The phase synchronization however has the disadvantage which is serious for practical use that the determined phase differences of the HF(IF) signals are always in the range between 0 and 2π. A phase shift of 2π corresponds to a time shift by the period duration T of the corresponding carrier oscillation. If between the reception signals time shifts larger than the period duration T occur, they are no longer correctly equalized and addition does not lead to an improvement in quality. This process, also called "PCD" (phase controlled diversity), would only allow equalization of alternate routes up to 0.35 m for example at a receiving frequency of 855 MHz. When PCD is used in current television[already], for very small path differences non-pertinent image contents would therefore be added and thus cause incorrect video reproduction.

Synchronization of the individual reception signals to one another is possible correctly only when the transmitted useful information itself is used to control synchronization. In [document]U.S. [D4]5,465,271, a digital communications system is described in which digital message bits are transmitted. Here the digital message is organized in frames and slots which contain a preamble. This is a special bit sequence which is known to the receiver. In this way the receiver can compare the received data to the data sequence known to it beforehand and can shift the individual reception signals to one another accordingly.

This known type of synchronization cannot be used in transmission of analog television signals since they have no frames, slots and preambles. Otherwise in this communications system the "preambles" of the input signals can be decoded to a sufficient degree and evaluated in the receiver only when the input signals are undisturbed and have little noise. For weak input signals however this is not the case so that this type of synchronization is not suited for a process of the initially mentioned type.

SUMMARY OF INVENTION

[The]An object of the invention is [therefore]to [make available]provide a process for mobile reception of television signals in which reception is enabled or further improved even in multipath propagation, regardless of the length of the alternate routes and thus the magnitude of the transit time differences and in areas with low reception levels.

[This object is achieved by the characterizing features of claim 1.]

According to this object of the invention there is provided a process for mobile reception of broadcast signals in which an output signal (S_A) is derived from a number (n) of different input signals (i.e. S_1.....S_5) and is supplied to the reproduction part of a receiver. In accordance with one aspect of the invention, the input signals (S_1.....S_n) are weighted and the output signal (S_A) is formed by summing the weighted input signals. For weighting, the quality of each of the

input signals (S_1.....S_n) is evaluated using at least one criterion which can be set for determining the adaptively determined weighting factors. According to this aspect, the n input signals (S_1...S_5) are time synchronized before their evaluation, summing and weighting. Horizontal and/or vertical video synchronization pulses contained in the input signals (S_1....S_5) may be used for control of time synchronization.

In this process with "time synchronization", the transit time difference of the reception signals is determined using the contained useful information and not using the phase angle of the carrier signal. By using deterministic signal portions, specifically the horizontal and vertical video synchronization pulses of the television signal, this can be done [especially]easily. The useful signals are then delayed against one another such that these signal portions (known beforehand) hit one another. The limit of the transit time equalization is no longer the period duration T of the carrier signal, but depends only on the type of deterministic signal portions contained (for example, their spacing) and the available memory.

This yields the advantage that at any time and essentially regardless of the size of the alternate signal routes and thus of the terrain traversed, on all [n]input signals, the same useful information for weighting and summing is available.

The use of the vertical and horizontal video synchronization pulse contained in the transmitted television signal for controlling transit time equalization conversely has the advantage (which is very important for practical use) that, based on the reliable decodability of the video synchronization pulses, even for very weak reception signals, the required transit time equalization can be done even under poor reception conditions. Thus, [also]under difficult conditions as often occur in practice, constructive weighted addition is enabled which leads decisively to improvement in the reception quality of the television picture.

The invention relates to mobile reception of television signals. In addition to video content, data such as teletext are also transmitted. It would be conceivable to decode these

data and to use the "frame/slot/preamble" to control synchronization similarly to [document]U.S. [D4.]5,465,271. But this would have the major disadvantage that decoding of digital information transmitted at the same time (like teletext) is possible only under very good receiving conditions. For this case however, weighted addition is no longer necessary, since then the receiving quality is good anyway.

[Advantageous]Other advantageous embodiments of the [process as claimed in claim 1]present invention are [given]set forth in the[dependent] claims.

[In a process as claimed in claim 2,]According to one aspect of the invention, a time interval, and thus a certain amount of data, can be stipulated for evaluation of n input signals. Thus a favorable compromise which can be adapted to the circumstances of the individual case between the attainable speed of the process and sufficient evaluation reliability is possible.

[Delay]According to another aspect of the invention, delay of the input signals[as claimed in claim 3] ensures that [in the process as claimed in the invention]correct weighting of the signals is done when the result of evaluation changes according to the evaluation time intervals.

Simple implementation of this delay can be achieved for example by so-called FIFO (first-in first-out) memories[(claim 4)].

[Signal]In accordance with a further aspect of the invention signal processing, therefore synchronization, signal evaluation and weighting, storage, multiplication and summation, can be accomplished especially easily and effectively when the input signals [as claimed in claim 5]are digital signals.

In [claim 6 the use of the process as claimed in the invention in the most frequent practical case of]a presently preferred embodiment, each input signal (S_1.....S_n) is received with its own antenna. According to this embodiment, with multipath reception in motor vehicles[is

given],[in which] the output signals of the tuners form the input signals for the following signal processing unit.

[Claims 7 and 8 give two]The invention contemplates various alternatives for preparing digital input signals in a multiantenna reception system. For example, high frequency signals received with antennas may already be digitally modulated. On alternatively, for example, television signals may be analog and digital input signals (S_1.....S_n) with luminance and chrominance portions produced by video decoders connected in series to tumors.

By evaluating the different signal portions of each input signal, [for example as claimed in claim 9 of]and specifically the luminance and the chrominance [portion]portions, the brightness and color signal of the various reception signals which is best at the time can be used for weighted summing.

The separation of the luminance and chrominance signal makes it possible for the two signals to be evaluated independently of one another, therefore criteria which are optimum at the time for evaluation and weighting of these signal portions can be used and thus the quality of the output signal in which the optimum luminance and chrominance signal are combined in a standard manner can be further improved.

[Examples of criteria for evaluation of]Any suitable criteria for evaluating signals may be employed with the present invention. For example, with color television signals[are cited in claims 10 to 12.], the magnitude of the noise level, the signal-to-noise ratio (of the signal level) or the occurrence of interference maybe be selectively used as criterion for evaluation of the quality of the input signals (S_1.....S_n). Alternatively, for example, the presence of a deterministic signal portion may be used as the criterion for evaluation. Likewise, as will be appreciated, a combination of any of these, or other, criterion may be used to evaluate the quality of input signals (S_1.....S_n).

Deterministic signal portions, for example, the horizontal and vertical synchronous information and the auxiliary color carrier in the current color television picture are predetermined, always present and prescribed signal components.

If the deterministic signal portions are absent or they are so [small]faint that they cannot be detected, [in the process as claimed in the aforementioned claims advantageously]the pertinent input signal is preferably not evaluated nor [is it]relayed for weighting.

[Claim 13 gives one advantageous possibility of determining the]A presently preferred weighting [factors. Here at the same time all]scheme weights the input signals [to be evaluated are]based on their rating compared [to]the input signal [assessed as]which is rated the best.

[Especially]According to the invention, an especially simple and economical evaluation of [the]input signals is achieved [as claimed in claim 14]by [those]equating input signals which, compared to the input signal assessed as best, fall below a certain threshold [and]to be weighted as a zero. Typically, these signals do not deliver a positive contribution to the output signal[, being weighted with] in the [zero]first [factor]place.

[Another advantageous application]According to another aspect of the [process as claimed in the]invention[as claimed in claim 15 consists in evaluating] at least one further block of m input signals (for example, audio signals) are evaluated in the described manner in addition to the first block of n input signals (for example, video signals) in order to improve their quality likewise and/or relative to the best individual signal.

[For]In accordance with the invention, in case of brief disruptions of reception during which the quality of all input signals cannot be used, [it is proposed as claimed in claim 16 that]the output signals may be buffered (after weighted summing) and[during the storage time] the undisrupted signals received [beforehand be]before the disruption are transmitted. [In]As will be appreciated, this simple manner, without high cost, the [fact]situation [that]where

no signal [at all]reaches the reproduction part of the receiver, for example, a monitor, during these disruptions, is avoided.

[As claimed in claim 17, in]According to another [advantageous embodiment]aspect of[the process as claimed in] the invention, input signals which do not contribute to the improvement of the output signal are not simply weighted very low or with zero, but are tuned to another frequency range with the same useful information, [therefore]for example, another television channel with the same program but better quality (frequency diversity).

[Claim 19 describes a circuit with which the process described in the preceding claims can be easily carried out.]

[The invention is explained below using one embodiment of a receiving device shown as a block diagram for executing the process as claimed in the invention.]

It is another object of the invention to provide a circuit for carrying out the aforementioned process. According to this object of the invention there is provided a circuit comprising a synchronization unit for time synchronization of the and/or m digital input signals (S_1.....S_n) consisting of one FIFO memory for each signal, a clock generator and a synchronization control unit. A signal conducting unit is provided in which each of the synchronized input signals (S_1.....S_n) is supplied via a signal evaluation circuit and a following means (for forming weighting factors) and another FIFO memory with a storage depth which corresponds to the time interval of signal evaluation and formation of the weighting factors. A multiplication and summary means is connected to a reproduction part of a receiver.

DETAILED DESCRIPTION

The receiving [device]means 1 for television reception in motor vehicles, for example in a passenger car, consists of a receiving unit 2, a synchronization unit 3 and a signal conditioning unit 4.

In the receiving unit 2 there are a number of different antennas, in this embodiment five different antennas [5]5, which are located at different points on the motor vehicle for receiving the same television program which can reach the antennas 5 as a result of the terrain structure by reflections on several propagation paths.

A tuner 6 tuned to the same useful signal in this example a (TV program) and a video decoder 7 are connected in series to each antenna 5. The tuners 6 can be tuned either to the same television channel or to different channels which transmit the same television program.

The synchronization unit 3 consists of one FIFO memory 8 each for each video signal delivered by the video decoders 7 and a clock generator 9 and a synchronization control unit 10.

In the signal conditioning unit 4 the output signals of the synchronization unit 3, therefore the input signals $S_1 ... S_5$ are delivered on the one hand via another FIFO memory 11 and on the other hand via an evaluation circuit 12 with a series-connected [device]means 13 for determining the weighting factors to a multiplication and summing [device]means 14 which is connected on the output side (optionally via a D/A converter) to a screen [which is](not shown). The high frequency signal received by the antennas 5 is relayed to the series-connected tuners 6. The latter demodulate the respective television signal and make available the analogous FBAS signal at their outputs.

The[following] video decoders 7 digitize these FBAS signals and separate the luminance and chrominance signal.

In addition to digital video data, the video decoders 7 deliver the pertinent clock and synchronization signals and status signals which show for example the presence of the color video carrier.

The receiving unit 2 thus makes available on five paths digital video data with the pertinent clock and synchronization data, these data of the individual paths being staggered in time to one another generally due to the different reception paths.

These time shifts are eliminated in the [following]synchronization unit 3. To do this, in the clock generator 9 using a common system clock and in the synchronization control unit 10 using the n input synchronization signals, control signals are produced from the input clock signals [and they]control the FIFO memory such that, at their output, the digital video data are [present]synchronized in time, and therefore have a common clock and synchronization signal.

These synchronized input signals $S_1...S_5$ are now subjected to the process [as claimed in the invention]in the signal conditioning unit 4. To do this, first the signal quality is assessed with respect to given criteria in the evaluation circuit 12 in parallel for all five paths. Then, the pertinent weighting factors are determined from the results of these signal evaluations in the [device]means 13.

Then the five synchronized input signals $S_1...S_5$ are multiplied by the pertinent weighting factors in the multiplication and summing [device]means 14 and these adaptively weighted signals are added to an output signal S_A which is supplied to the screen optionally via a D/A converter. So that the correct video data are used for the adaptively weighted summing, specifically those which have already been used for evaluation and determination of the weighting factors, the input signals $S_1...S_5$ are delayed in a FIFO memory 11 with a storage

depth which corresponds to the time interval which is necessary for evaluation and determination of the weighting factor. In this example there is one video line at a time.

Summing of all adaptively weighted video signals ensures that the output television signal S_A made available to the receiver in the least favorable case, i.e. when four input signals receive weighting zero, corresponds to the best of the five input signals and in all other cases has better quality.

Claims]

CLAIMS

1. [1.]Process for mobile reception of television signals in which an output signal (S_A) is derived from n different [input signals](S_1...S_5) and is supplied to the reproduction part of the receiver, the n input signals (S_1...S_5) being weighted, the output signal (S_A) being formed by summing of the weighted input signals, and the quality of each of the n input signals (S_1...S_5) being evaluated using at least one given criterion for determining the adaptively determined weighting factors, characterized in that the n input signals (S_1...S_5) are time-synchronized before their evaluation, summing and weighting, and the horizontal and/or vertical video synchronization pulses contained in the input signals (S_1...S_5) are used for control of time synchronization.

2. [2.]Process as claimed in claim 1, wherein there is a time interval which can be set for evaluating the input signals (S_1...S_5).

3. [3.]Process as claimed in claim 1 or 2, wherein the input signals (S_1...S_5) are delayed before adaptive summing until the pertinent weighting factors are determined.

4. [4.]Process as claimed in claim 3, wherein a FIFO memory (11) is used for delay.

5. [5.]Process as claimed in one of claims 1 to 4, wherein the input signals (S_1...S_5) are digital signals.

6. [6.]Process as claimed in claim 5, wherein each of the input signals (S_1...S_5) is received with its own antenna (5) and its own tuner (6).

7. [7.]Process as claimed in claim 6, wherein the high frequency signals received with the antennas (5) are already digitally modulated.

8. [8.]Process as claimed in claim 7, wherein the television signals are analog and digital input signals (S_1...S_5) with luminance and chrominance portion are produced by the video decoders (7) connected in series to the tuners (6).

9. [9.]Process as claimed in claim 7 or 8, wherein the luminance and chrominance portion of each input signals (S_1...S_5) are evaluated, weighted, summed and then combined again in the standard manner independently of one another.

10. [10.]Process as claimed in claim 9, wherein the magnitude of the noise level, the signal-to-noise ratio of the signal level or the occurrence of interference are used selectively as the criterion to evaluate the quality of the input signals (S_1...S_5).

11. [11.]Process as claimed in claim 9, wherein the presence of a deterministic signal portions is used as the criterion to evaluate the quality of the input signals (S_1...S_5).

12. [12.]Process as claimed in claim 9, wherein a combination of criteria as claimed in claims 10 and 11 is used as the criterion to evaluate the quality of the input signals (S_1...S_5).

13. [13.]Process as claimed in one of the preceding claims, wherein the input signals (S_1...S_5) are weighted according to their rating compared to the input signal which has been rated best.

14. [14.]Process as claimed in claim 13, wherein the input signals (S_1...S_5), with a rating which falls below a threshold which can be set compared to the input signal rated best are weighted with the factor zero.

15. [15.]Process as claimed in one of claims 1 to 13, wherein parallel to the n input signals (S_1...S_5) with a certain content (video signals) at least m other input signals with another content (audio signals) are evaluated, weighted, and summed.

16. [16.]Process as claimed in one of claims 1 to 15, wherein after weighted summing, the output signals (S_A) are buffered and the undisrupted signals received beforehand are transmitted during brief interference.

17. [17.]Process as claimed in one of claims 1 to 16, wherein receiving paths with input signals (S_1...S_5) which do not contribute to improving the output signal are set to different frequency ranges with the same useful information, but better quality.

18. [18.]Circuit for carrying out one of the processes as claimed in claim 1 to 17, characterized by a synchronization unit (3) for time synchronization of the n or m digital input signals (S_1...S_5) consisting of one FIFO memory (8) for each signal, a clock generator (9) and a synchronization control unit (10), and by a signal conditioning unit (4) in which each of the synchronized input signals (S_1...S_5) is supplied on the one hand via a signal evaluation circuit (12) and a following [device]means (13) for forming the weighting factors and on the other via another FIFO memory (11) with a storage depth which corresponds to the time interval of signal evaluation and formation of the weighting factors, to a multiplication and summing [device]means (14) which is connected on the output side to the reproduction part of the receiver.

ABSTRACT

Process for mobile reception of television signals in which an output signal (S_A) is derived from n different (S_1...S_5) and is supplied to the reproduction part of the receiver, the n input signals (S_1...S_5) being weighted, the output signal (S_A) being formed by summing of the weighted input signals, and the quality of each of the n input signals (S_1...S_5) being evaluated using at least one given criterion for determining the adaptively determined weighting factors, characterized in that the n input signals (S_1...S_5) are time-synchronized before their evaluation, summing and weighting, and the horizontal and/or vertical video synchronization pulses contained in the input signals (S_1...S_5) are used for control of time synchronization.

Translation of Article 34
Amendment to Specification

New introductory part of the specification

Process for mobile reception of television signals

and a circuit for executing the process

The invention relates to a process as claimed in the preamble of claim 1 and a circuit for executing the process.

Formation of an output signal which is supplied to the receiver by summing of input signals weighted according to quality criteria is already known from documents US 5,528,581, DE 38 33 709 A1, DE 197 08 996 A1 and US 5,465,271.

Compared to other methods of multipath reception, as are known from DE 39 26 336 A1, DE 196 36 125 A1 and DE 197 39 898 A1, in which at any time only the use of one (the best) individual signal is enabled and thus the output signal supplied to the receiver is at most as good as the best input signal, an improvement can be achieved compared to the best input signal by addition of weighted input signals.

This advantage however can only be achieved when the transit time differences of the received television signals generally caused by different propagation paths are determined and equalized before their addition. Without this compensation, as is the case in the diversity transmission system described in US patent 5,528,581, the acquired useful information is not improved, but degraded.

Generally a path difference and thus a transit time difference of the received signals occur on different propagation paths of a signal. By summing of these reception signals the received useful information is not improved, but degraded. It is therefore necessary to determine and equalize the transit time differences before addition.

Transit time equalization is not done in document D1.

In the diversity process known from document D2, first the respective phase of the HF carrier oscillations of the various reception signals is determined and then phase correction is done for compensation of transit time differences.

Instead of the phases of the HF signals, also those of the pertinent IF signals can be determined and thus delay correction circuits can be controlled, as is the case in the diversity process according to document D3.

The phase synchronization however has the disadvantage which is serious for practical use that the determined phase differences of the HF(IF) signals are always in the range between 0 and 2π. A phase shift of 2π corresponds to a time shift by the period duration T of the corresponding carrier oscillation. If between the reception signals time shifts larger than the period duration T occur, they are no longer correctly equalized and addition does not lead to an improvement in quality. This process, also called "PCD" (phase controlled diversity), would only allow equalization of alternate routes up to 0.35 m for example at a receiving frequency of 855 MHz. When PCD is used in current television already for very small path differences non-pertinent image contents would therefore be added and thus cause incorrect video reproduction.

Synchronization of the individual reception signals to one another is possible correctly only when the transmitted useful information itself is used to control synchronization. In document D4 a digital communications system is described in which digital message bits are transmitted. Here the digital message is organized in frames and slots which contain a preamble. This is a special bit sequence which is known to the receiver. In this way the receiver can compare the received data to the data sequence known to it beforehand and can shift the individual reception signals to one another accordingly.

This known type of synchronization cannot be used in transmission of analog television signals since they have no frames, slots and preambles. Otherwise in this communications system the "preambles" of the input signals can be decoded to a sufficient degree and evaluated in the receiver only when the input signals are undisturbed and have

little noise. For weak input signals however this is not the case so that this type of synchronization is not suited for a process of the initially mentioned type.

The object of the invention is therefore to make available a process for mobile reception of television signals in which reception is enabled or further improved even in multipath propagation, regardless of the length of the alternate routes and thus the magnitude of the transit time differences and in areas with low reception levels.

This object is achieved by the characterizing features of claim 1.

In this process with "time synchronization" the transit time difference of the reception signals is determined using the contained useful information and not using the phase angle of the carrier signal. By using deterministic signal portions, specifically the horizontal and vertical video synchronization pulses of the television signal, this can be done especially easily. The useful signals are then delayed against one another such that these signal portions known beforehand hit one another. The limit of the transit time equalization is no longer the period duration T of the carrier signal, but depends only on the type of deterministic signal portions contained (for example, their spacing) and the available memory.

This yields the advantage that at any time and essentially regardless of the size of the alternate signal routes and thus of the terrain traversed, on all n input signals the same useful information for weighting and summing is available.

The use of the vertical and horizontal video synchronization pulse contained in the transmitted television signal for controlling transit time equalization conversely has the advantage which is very important for practical use that based on the reliable decodability of the video synchronization pulses even for very weak reception signals the required transit time equalization can be done even under poor reception conditions. Thus, also under difficult conditions as often occur in practice, constructive weighted addition is enabled which leads decisively to improvement in the reception quality of the television picture.

The invention relates to mobile reception of television signals. In addition to video content, data such as teletext are also transmitted. It would be conceivable to decode these

data and to use the "frame/slot/preamble" to control synchronization similarly to document D4. But this would have the major disadvantage that decoding of digital information transmitted at the same time (like teletext) is possible only under very good receiving conditions. For this case however weighted addition is no longer necessary, since then the receiving quality is good anyway.

Advantageous embodiments of the process as claimed in claim 1 are given in the dependent claims.

In a process as claimed in claim 2, a time interval and thus a certain amount of data can be stipulated for evaluation of n input signals. Thus a favorable compromise which can be adapted to the circumstances of the individual case between the attainable speed of the process and sufficient evaluation reliability is possible.

Delay of the input signals as claimed in claim 3 ensures that in the process as claimed in the invention correct weighting of the signals is done when the result of evaluation changes according to the evaluation time intervals.

Simple implementation of this delay can be achieved for example by so-called FIFO (first-in first-out) memories (claim 4).

Signal processing, therefore synchronization, signal evaluation and weighting, storage, multiplication and summation, can be accomplished especially easily and effectively when the input signals as claimed in claim 5 are digital signals.

In claim 6 the use of the process as claimed in the invention in the most frequent practical case of multipath reception in motor vehicles is given, in which the output signals of the tuners form the input signals for the following signal processing unit.

Claims 7 and 8 give two alternatives for preparing digital input signals in a multiantenna reception system.

By evaluating the different signal portions of each input signal, for example as claimed in claim 9 of the luminance and the chrominance portion, the brightness and color

signal of the various reception signals which is best at the time can be used for weighted summing.

The separation of the luminance and chrominance signal makes it possible for the two signals to be evaluated independently of one another, therefore criteria which are optimum at the time for evaluation and weighting of these signal portions can be used and thus the quality of the output signal in which the optimum luminance and chrominance signal are combined in a standard manner can be further improved.

Examples of criteria for evaluation of color television signals are cited in claims 10 to 12.

Deterministic signal portions, for example, the horizontal and vertical synchronous information and the auxiliary color carrier in the current color television picture are predetermined, always present and prescribed signal components.

If the deterministic signal portions are absent or they are so small that they cannot be detected, in the process as claimed in the aforementioned claims advantageously the pertinent input signal is not evaluated nor is it relayed for weighting.

Claim 13 gives one advantageous possibility of determining the weighting factors. Here at the same time all the input signals to be evaluated are compared to the input signal assessed as best.

Especially simple and economical evaluation of the input signals is achieved as claimed in claim 14 by those input signals which, compared to the input signal assessed as best, fall below a certain threshold and do not deliver a positive contribution to the output signal, being weighted with the zero factor.

Another advantageous application of the process as claimed in the invention as claimed in claim 15 consists in evaluating at least one further block of m input signals (for example, audio signals) in the described manner in addition to the first block of n input signals (for example, video signals) in order to improve their quality likewise relative to the best individual signal.

For the case of brief disruptions of reception during which the quality of all input signals cannot be used, it is proposed as claimed in claim 16 that the output signals be buffered after weighted summing and during the storage time the undisrupted signals received beforehand be transmitted. In this simple manner, without high cost the fact that no signal at all reaches the reproduction part of the receiver, for example, a monitor, during these disruptions, is avoided.

As claimed in claim 17, in another advantageous embodiment of the process as claimed in the invention, input signals which do not contribute to the improvement of the output signal are not simply weighted very low or with zero, but are tuned to another frequency range with the same useful information, therefore for example another television channel with the same program but better quality (frequency diversity).

Claim 19 describes a circuit with which the process described in the preceding claims can be easily carried out.

Translation of Article 34
Amendment to Claims

Claims

1. Process for mobile reception of television signals in which an output signal (S_A) is derived from n different input signals (S_1...S_5) and is supplied to the reproduction part of the receiver, the n input signals (S_1...S_5) being weighted, the output signal (S_A) being formed by summing of the weighted input signals, and the quality of each of the n input signals (S_1...S_5) being evaluated using at least one given criterion for determining the adaptively determined weighting factors, characterized in that the n input signals (S_1...S_5) are time-synchronized before their evaluation, summing and weighting, and the horizontal and/or vertical video synchronization pulses contained in the input signals (S_1...S_5) are used for control of time synchronization.

2. Process as claimed in claim 1, wherein there is a time interval which can be set for evaluating the input signals (S_1...S_5).

3. Process as claimed in claim 1 or 2, wherein the input signals (S_1...S_5) are delayed before adaptive summing until the pertinent weighting factors are determined.

4. Process as claimed in claim 3, wherein a FIFO memory (11) is used for delay.

5. Process as claimed in one of claims 1 to 4, wherein the input signals (S_1...S_5) are digital signals.

6. Process as claimed in claim 5, wherein each of the input signals (S_1...S_5) is received with its own antenna (5) and its own tuner (6).

7. Process as claimed in claim 6, wherein the high frequency signals received with the antennas (5) are already digitally modulated.

8. Process as claimed in claim 7, wherein the television signals are analog and digital input signals (S_1...S_5) with luminance and chrominance portion are produced by the video decoders (7) connected in series to the tuners (6).

9. Process as claimed in claim 7 or 8, wherein the luminance and chrominance portion of each input signals (S_1...S_5) are evaluated, weighted, summed and then combined again in the standard manner independently of one another.

10. Process as claimed in claim 9, wherein the magnitude of the noise level, the signal-to-noise ratio of the signal level or the occurrence of interference are used selectively as the criterion to evaluate the quality of the input signals (S_1...S_5).

11. Process as claimed in claim 9, wherein the presence of a deterministic signal portions is used as the criterion to evaluate the quality of the input signals (S_1...S_5).

12. Process as claimed in claim 9, wherein a combination of criteria as claimed in claims 10 and 11 is used as the criterion to evaluate the quality of the input signals (S_1...S_5).

13. Process as claimed in one of the preceding claims, wherein the input signals (S_1...S_5) are weighted according to their rating compared to the input signal which has been rated best.

14. Process as claimed in claim 13, wherein the input signals (S_1...S_5), with a rating which falls below a threshold which can be set compared to the input signal rated best are weighted with the factor zero.

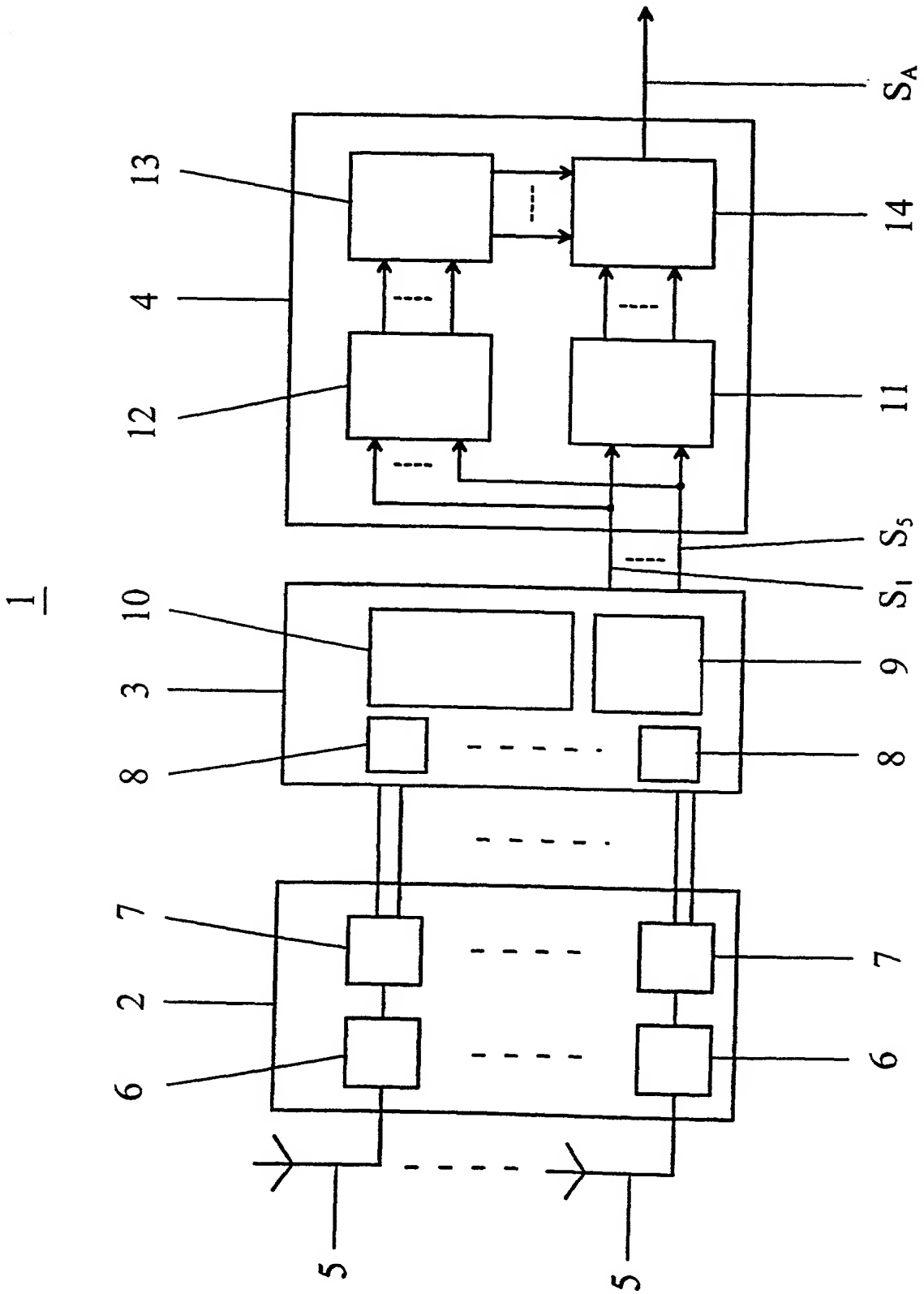
15. Process as claimed in one of claims 1 to 13, wherein parallel to the n input signals (S_1...S_5) with a certain content (video signals) at least m other input signals with another content (audio signals) are evaluated, weighted, and summed.

16. Process as claimed in one of claims 1 to 15, wherein after weighted summing, the output signals (S_A) are buffered and the undisrupted signals received beforehand are transmitted during brief interference.

17. Process as claimed in one of claims 1 to 16, wherein receiving paths with input signals (S_1...S_5) which do not contribute to improving the output signal are set to different frequency ranges with the same useful information, but better quality.

18. Circuit for carrying out one of the processes as claimed in claim 1 to 17, characterized by a synchronization unit (3) for time synchronization of the n or m digital

input signals (S_1...S_5) consisting of one FIFO memory (8) for each signal, a clock generator (9) and a synchronization control unit (10), and by a signal conditioning unit (4) in which each of the synchronized input signals (S_1...S_5) is supplied on the one hand via a signal evaluation circuit (12) and a following device (13) for forming the weighting factors and on the other via another FIFO memory (11) with a storage depth which corresponds to the time interval of signal evaluation and formation of the weighting factors, to a multiplication and summing device (14) which is connected on the output side to the reproduction part of the receiver.



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	§	
	§	
Wolfgang Sautter, et al.	§	Docket No.: 197.022
	§	
Serial No.: To be assigned	§	
	§	
Filed: Herewith	§	
	§	
Title: Process for Mobile Reception of Television Signals and a Circuit for Executing the Process	§	

POWER OF ATTORNEY BY ASSIGNEE

Box Patent Application
Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

As named Assignee for the above-identified application, it is requested that the following attorneys be appointed to prosecute and transact all business in the Patent and Trademark Office connected therewith.

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GmbH & CO.KG

Date: January 25, 2002

i. V. Dr. Ing. i.V. f-l
Name
Title

Docket No. 197.022

DECLARATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am an original, first and joint inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled:

PROCESS FOR MOBILE RECEPTION OF TELEVISION SIGNALS AND A CIRCUIT FOR EXECUTING THE PROCESS

the specification of which [check one]

[ ] is attached hereto

[X] was described and claimed in PCT International Application No. PCT/EP00/04553 filed on May 20, 2000 and as amended under PCT Article 34 July 10, 2001 if any).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

PRIOR FOREIGN APPLICATION(S)			Priority Claimed
199 29 284.1 (Number)	Germany (Country)	25 June 1999 (Day/Month/Year filed)	[X] Yes [ ] No
(Number)	(Country)	(Day/Month/Year filed)	[ ] Yes [ ] No
(Number)	(Country)	(Day/Month/Year filed)	[ ] Yes [ ] No

I hereby claim the benefit under Title 35, United States Code §120 of any United States application(s) listed below and insofar as the subject matter of each of the claims of this application is not disclosed in the prior U.S. application in the manner provided by the first paragraph of Title 35, U.S.C. §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations §1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application.

(Application Serial No.)	(Filing Date)	(Status: patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status: patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

1-00

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